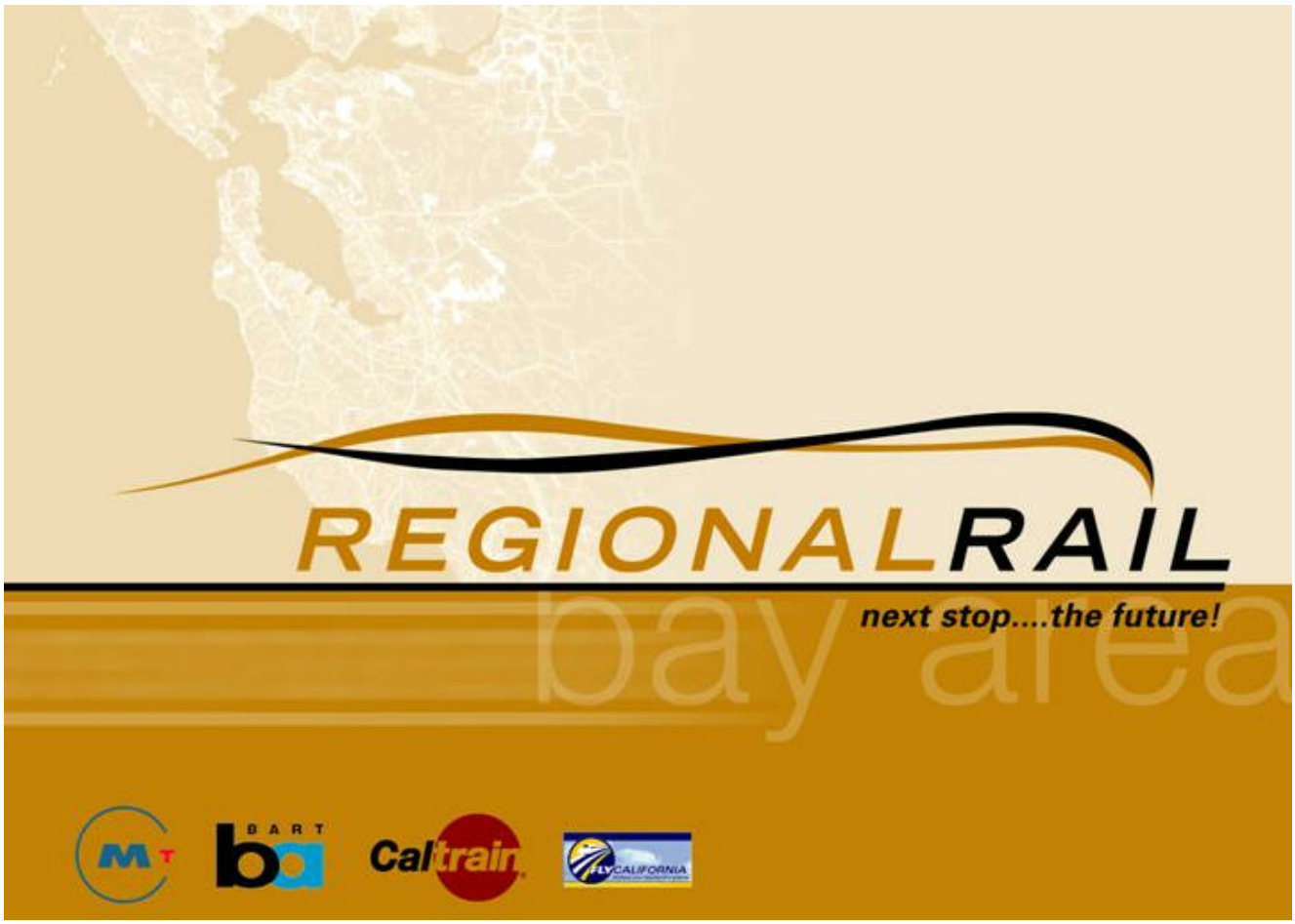
BAY AREA REGIONAL RAIL PLAN
CONCEPTUAL ALTERNATIVES TASK

Technical Memorandum 2.b

Methodology for Development of Systemwide Study Alternatives



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INTRODUCTION

The purpose of this memo is to present the proposed methodology for combining the initial list of options assembled from the outreach and initial planning efforts into a set of systemwide Study Alternatives.

The Regional Rail Project Team, with representatives from the Metropolitan Transportation Commission (MTC), Bay Area Rapid Transit District (BART), Caltrain, and the California High Speed Rail Authority (CHSRA), has concluded a round of public workshops throughout Northern California to obtain input on provisions of the Regional Rail Plan.

In addition, the Earth Tech / KORVE consultant team has conducted a week-long planning charrette which included representatives from regional transportation planning entities, transit service providers, and a focus group of interested parties.

As a result of these outreach efforts, and with input from the Project Team and Consultant Team, a long list of potential services options, route alignments, stations and intermodal facilities has been assembled.

Through this process, a wide range of thematic considerations and questions has emerged…

- Can passenger and freight continue to be served on the same system?
- How will the rail system accommodate the very large increases projected for freight movement?
- What type of service should BART technology be used to provide in the ultimate regional system?
- How will High Speed Rail routes integrate in corridors with existing and proposed services?

In addition, comments were received regarding the study approach and work plan, specifically:

- It was noted that the study provides an opportunity to look at the BART system in a visionary way, in the manner which was accomplished when the first system plan was put together
- Concern was expressed regarding how alternatives were to be fashioned given the nearly limitless combinations of options in play in various areas of the very large study area
- It was recognized that land use is key factor driving transportation choices; how would the study process address this key element?
- High Speed Rail staff indicated that they did not believe it would be appropriate to screen down the numerous potential combinations of line segments for entry into and service to the Bay Area into one or two options for alternatives which enter from the east

In response to these issues, concerns and considerations, it is proposed that a thematic approach be used to formulate alternative visions for the various services and plan elements,

and that these visions be utilized to guide the selection of Study Alternatives incorporating the various alignment, stations and services proposals.

In accordance with this approach for conducting Phase 1 of the Regional Rail study, candidate options for rail service will not be formally evaluated and screened; rather, efforts will be made to develop an inclusive set of Study Alternatives that generally encompass the options identified to date, using alternative vision statements to guide the formulation of the various alternatives.

STUDY THEMES

There are five major elements at the core of the Regional Rail Study:

- BART;
- Railroad-based Regional Passenger Services, e.g., Capitol Corridor, Caltrain, ACE, etc.;
- High Speed Rail;
- Accommodation of increased rail freight movements due to economic growth;

And,

- Long term land use including the impact of "smart growth" policies.

For each of these elements, a range of ideas has emerged, as noted below:

Regional Transit / BART

Should BART focus on Core Capacity? Should BART continue to work towards the vision provided in the initial system plan with service to the entire Bay Area? Should BART become more like a true mass transit operation with more frequently spaced local stops and express trains serving selected major stations?

Railroad-Based Regional Passenger Services

To what extent should regional rail services continue to rely upon and make capacity and operational improvements to existing freight railroads? Should the Bay Area plan for and develop a new railroad-based passenger system separate from freight operations and lines?

High Speed Rail

If new high speed lines are developed to connect the existing major regional centers with a statewide service, what opportunities for "overlay services" – regional services using compatible equipment with additional stations, track and other facilities as necessary – to operate in conjunction with the statewide service plan?

Freight Movements

Can the freight railroads accommodate the increases in traffic, especially those associated with the growth in world trade, and still continue to support passenger operation? Can trains be dispatched more efficiently to allow for expansion of passenger services? Can abandoned or

underutilized lines be improved and used to provide the network capacity to serve future freight and passenger traffic?

Land Use

Do passenger lines serve current and future population centers? Are proposed rail improvements appropriate for current and proposed land uses? What benefits would accrue either in terms of increased ridership or less investment to serve demands with ambitious "smart growth" policies?

STUDY PROCESS

In order to engage the big picture, thematic concerns and considerations, while at the same time reflecting the most inclusive range in alignment, station and services options, a planning process that includes five major steps is proposed as outlined below:

1. Each of the separate systems (BART, High Speed Rail, Railroad-based Passenger Services and Goods Movement) will be reviewed and a series of Vision Statements will be developed – Vision Statements are framed to provide thematic descriptions of the range of options assembled in the outreach and initial identification of alternatives process.

2. The Vision Statements are evaluated in relationship to each other resulting in the identification of compatible (vs. incompatible) themes that could be used to develop systemwide networks from the long list of network options.

3. Principal corridors will be defined within the Northern California study area and a series of corridor-by-corridor "Building Blocks" will be defined. The "Building Blocks" options for each corridor identify consistent treatment of all of the systems (BART, High Speed Rail, Railroad-based Passenger Services and Goods Movement) using compatible Vision Statements, as identified in Step 2.

4. Study Alternatives that do not include HSR will be assembled using the "Building Block" options that are based upon compatible Vision Statements. As presented in this methodology, there will be three such resulting systemwide Study Alternatives, plus the base case or "No Project" alternative that includes MTC's Regional Transit Expansion Program (MTC Resolution 3434). In corridors where there are fewer than three distinctly different Building Block options, the most appropriate Building Blocks will be assembled consistent with the remainder of the particular Study Alternative.

5. In accordance with the request from California High Speed Rail Authority not to screen out potentially viable HSR links at this point in the planning process, a series of HSR alternatives which jointly encompass all of the most likely combinations of links serving the three major centers (San Francisco, Oakland and San Jose) will be identified as the basis for Study Alternatives with HSR. As presented in this methodology, there will be nine such alternatives.

Using the overall approach described above, corridor-level options and alignment sub-options will be carried forward for more detailed analysis amongst the resulting Study Alternatives (nine HSR alternatives and three non-HSR alternatives, plus a Base Case). Refinements to the Study

Alternatives will be accomplished based upon inputs from the Steering Committee, public meetings, stakeholders and other interested parties.

Following full technical analysis of the Study Alternatives versus the Base Case, the study would designate the most promising systemwide alternatives both for scenarios without High Speed Rail as well as for scenarios which include High Speed Rail either from the East or South. At this point in time, detailed cost, travel time, and impact information for alignment and stations on a corridor-by-corridor basis will be available allowing for further refinement of plan options, including "mixing and matching" portions of the Study Alternatives to develop three recommended alternatives for the "HSR – South Entry", "HSR – East Entry" and "No HSR" outcomes.

Evaluation of the travel performance, cost and impacts of the System Alternatives at the two outside horizon years (2030 and 2040/50) would be used to distinguish the Year 2030 plan from the Year 2050 plan based upon corridor-level analysis and phasing considerations; The Year 2030 plan would be developed building upon the Resolution 3434 network with additional improvements consistent with the ultimate network.

DEFINING SYSTEM ALTERNATIVES – STEP 1: VISION STATEMENTS

The previously-noted study themes have been distilled into sets of three alternative "Vision Statements" for each of the principal services for which planning is proceeding, as presented below. The Vision Statements are intended to describe significantly different thematic approaches to development of each of the services within the Study Alternatives.

BART

1. BART is extended and expanded beyond the Resolution 3434 base case to become a system providing regional service throughout the Bay Area counties similar to the original BART plan.

2. BART is not extended but infill stations are constructed and service is concentrated to provide mass transit service in dense areas with express service and/or skip stop service being used to provide adequate travel times for longer length trips.

3. The BART system remains largely as is, with improvements focused on core capacity needs; alternative technologies are used to extend coverage except where short extensions of the BART technology would provide the most beneficial solution.

Railroad-Based Passenger Services

1. Rail is upgraded to ultimately provide 115 mph service operating throughout the region on separate electrified grade-separated trackage along principal line segments; passenger service is withdrawn from existing freight tracks along principal lines thereby improving capacity for goods movement. On selected dedicated passenger trackage, a mix of FRA-compliant and FRA non-compliant equipment is allowed thereby providing access to major population centers for high speed rail non-compliant equipment.

2. Appropriate capacity and operational improvements including signaling, passing tracks and/or multi-tracking and route realignments are constructed along shared lines to accommodate the projected increase in combined passenger and freight demand in

shared freight / passenger corridors using FRA-compliant equipment with higher speeds. High speed rail, if present, would be on separate trackage using non-FRA compliant equipment.

3. A hybrid strategy is pursued in which the rail solution is selected on a corridor-by-corridor basis to select the most appropriate vehicle technology and running way treatment with consideration for adjacent corridors and other systems (e.g., BART and High Speed Rail) so that a consistent, workable systemwide plan results.

Freight

1. Future freight movements are dispatched by freight railroads consistent with existing practices and improvements are made to existing freight lines to accommodate traffic growth.

2. Future freight movements are dispatched to optimize the utilization of regional rail infrastructure and improvements are made within existing rights of way to accommodate traffic growth needs (consistent with the existing industry practice of inter-railroad "haulage agreements").

3. Portions of the regional rail system are consolidated under public ownership and future freight movements are controlled from a consolidated passenger – freight dispatch center hands off freight trains to the private railroads at selected points of connection. Improvements are made both within existing rights of way as well as along other available rights of way to accommodate traffic growth. Freight traffic is routed away from major urban areas where feasible.

High Speed Rail

As noted previously, High Speed Rail staff has requested that the study provide analysis capable of analyzing a large number of combinations line segments to service the three major centers in the Bay Area. In addition, as the focus of the study is provision of regional passenger services, the study needs to identify and evaluate the opportunities for overlay services along potential High Speed Rail lines. Accordingly, the following approach will be used for study of High Speed Rail options:

1. Options will be developed that will provide service to all three of the major Bay Area population centers (Oakland, San Francisco and San Jose). Combinations of links within the inner Bay Area that serve these destinations will not be screened but will be used to define a series of alternatives for further study based around the high speed rail definition paired with the most consistent corridor-specific treatment for BART and railroad services.

2. There are two alignment options for entry into the Bay Area from the south, one south of Merced (via Henry Miller Road) and one north of Merced (GEA North), both following SR-152 through the Pacheco Pass to the Caltrain/UPRR right-of-way south of Gilroy.

3. Efforts accomplished to date in the present study has resulted in the identification of three major alternatives for entry into the Bay Area from the east, one via I-580, one via the UPRR Oakland Subdivision right-of-way, and one via Patterson Pass to south of the developed areas of Livermore and Pleasanton.

4. For Central Valley options, the following alignment options will be investigated – the UPRR alignment between Sacramento and Fresno, the CCT alignment between Sacramento and Stockton, and the BNSF alignment between Stockton and Fresno. A new alignment bypass just east of Stockton and Lodi will also be considered for express services.

5. High Speed Rail planning efforts have included consideration for development of regional "overlay" services using the high-speed statewide infrastructure with additional investments in facilities and compatible rolling stock necessary to support all of the proposed services. As High Speed Rail development would result in a major infrastructure investment, the Regional Rail study will identify and evaluate options for providing overlay services with High Speed Rail lines where such services appear to be promising.

Land Use

Analysis of land use within the study area has identified three significantly different patterns of development that are prevalent. Development patterns within the various identified corridors (which are identified further on in this methodology) exhibit traits of one or more of these patterns and the interplay of these patterns in concert with underlying economic factors and land use policies helps define future development potentials. These options are described as follows (refer to the Regional Rail Economic/Land Use Outlook White Paper for specifics):

1. Urban Infill "Core" Development – Reflects concentration of growth within existing urban areas by focusing growth on vacant or underutilized lands. The fulfillment of this scenario is largely contingent on the employment and land use outlooks for the Inner Bay Area.

2. Urban-Suburban "Hub and Spoke" Development – Even with policies encouraging urban infill, future development will to some degree reflect continued suburbanization within the overall study area. Hub and spoke development is reflected by further development of residential-intensive communities surrounding the inner Bay Area.

3. Regional "Web" Development – Growth of outlying areas serving clusters of employment and housing tied to local industry geography.

The intention of the transportation planning process is to develop rail solutions which are consistent with the predominant land use patterns and current federal, regional and local transit investment policies to maximize the linkage between land use and transportation. These policies will provide a framework for the development of evaluation criteria, project priority and/or selection thresholds as part of the implementation for the regional rail plan.

DEFINING STUDY ALTERNATIVES – STEP 2: COMPATIBLE THEMES

Among the nine vision statements for the three principal passenger systems and freight, there are a total of 27 possible combinations and the multiplicity of the High Speed Rail network combinations increases the complexity by an order of magnitude. However, certain theme combinations are more internally consistent than others. For example, with no High Speed Rail network, either BART or Railroad Services could evolve to become the principal regional carrier. Alternatively, in corridors where a major investment is made in a High Speed Rail link, investment in a competing railroad-based passenger service or major new BART line may not be cost-effective compared to making an incremental investment to provide overlay regional services along the High Speed Rail line.

As described on pages 4 and 5, there are three alternative visions each for BART and Railroad services. However BART Vision #1 (BART expands to provide regional coverage) conflicts with Rail Vision #1 (develop new separate regional passenger rail network) whereas BART Vision #2 (BART as mass transit provider) is compatible with Rail Vision #1 and vice versa. In addition, BART Vision #3 (focus on core capacity and operations rather than expansion of coverage) is compatible with Rail Vision #3 (use wide mix of strategies to develop new railroad-based services) so it would makes sense for planning purposes to pair up these combinations of strategies resulting in three Study Alternatives inclusive of the BART and Railroad visions.

It is also possible to match up the three alternative freight services visions with the above three combinations. For example, Freight Vision #1 (continuation of existing practices) is compatible with Rail Vision #1 (development of separate passenger lines) because with separate passenger lines there would be no need to alter freight handling operations solely to accommodate regional passenger rail. Likewise, pursuit of Rail Vision #2 (expansion of passenger operations shared with freight) will most likely require changes in operating practices at least to the extent implied in Freight Vision #2 (haulage agreements to optimize flows) in order to maximize the public investments in capacity and operational improvements. Finally, Freight Vision #3 (with development of new freight by-pass lines to move traffic more efficiently and away from the urban centers) is compatible with Rail Vision #3 in which a wide range of strategies is adopted on a corridor-by-corridor basis to expand rail services and freight capacity. In this context, the nine separate Vision Statements for BART, Railroad-based Passenger Services and Freight can be combined into three consistent and distinct themes as summarized in Table 1.

Table 1
Regional Rail Alternatives with Alternative BART, Railroad-Based Services and Freight Visions
(No High Speed Rail)

	Alternative 1	Alternative 2	Alternative 3
BART	• BART system is expanded to provide regional coverage (BART Vision #1)	• BART system provides more dense service in urban areas and express service in outlying areas (BART Vision #2)	• BART focuses on addressing core capacity issues; extensions are limited to those needed for improved connectivity (BART Vision #3)
Railroad Services	• Passenger services are expanded along lines shared with freight traffic (Rail Vision #2)	• New higher speed passenger railroad lines are developed to handle regional passenger flows (Rail Vision #1)	• Railroad services are expanded in a hybrid fashion using corridor-specific technologies and operating plans (Rail Vision #3)
Freight	• Freight movements are dispatched to optimize the utilization of regional rail infrastructure; improvements are made within existing rights of way to accommodate traffic growth needs (Freight Vision #2)	• Freight movements are dispatched similar to existing practices; investments are made to existing freight principal lines to accommodate goods movement (Freight Vision #1)	• Portions of the regional rail system are improved under public ownership with consolidated dispatching; freight by-pass lines are developed to route freight traffic away from major urban areas where feasible. (Freight Vision #3)

DEFINING STUDY ALTERNATIVES – STEP 3: PRINCIPAL CORRIDORS

In order to facilitate the assembly of System Alternatives the Regional Rail study area has been divided up into corridors. Within each corridor, the intention is to develop alternative packages or "Building Blocks" composed of consistent alignment and station options to support all of the proposed services. The Building Blocks can then be combined at the outset of the technical analysis in various ways to result in consistent System Alternatives and could also potentially be "mixed and matched" based upon the results of the analysis to refine the recommended alternatives.

Corridors have been defined as areas connecting between major population centers where a substantial portion of the trunk travel within the corridor is longitudinally along the defined route. To the extent possible, corridors defined in this process are geographically distinct; however, they may overlap at major regional centers, in which case some of the corridor rail infrastructure may be shared between services serving multiple corridors. For the purpose of this planning process, corridors may also terminate at a junction along another corridor of greater extent.

Within the overall Northern California planning area bounded by Cloverdale and Auburn to the northwest and northeast and by Monterey and Merced to the southwest and southeast there are numerous distinct transportation corridors. However, given that the rail plan is centered on the Bay Area, all of the regional services and options identified to date can be defined in terms of ten corridors (Figure 1), as identified below:

1. US 101 North – Extends along the route of US 101 and the Northwest Pacific from Cloverdale to San Francisco

2. I-80 – Extends along the Capitol Corridor and Interstate 80 from Auburn to Oakland

3. North Bay – Infill corridor north of San Pablo Bay and Strait connecting between the US 101 North and I-80 corridors (cities of Petaulma-Novato-San Rafael to cities of Fairfield-Vallejo-Richmond); includes east-west travel parallel to I-580, Route 37 and Routes 121-12-116 as well as north-south travel between Vallejo and Napa

4. Peninsula – Extends along Caltrain and US 101 from San Francisco to San Jose

5. South Counties – Extends along US 101 and Route 1 south from San Jose to Monterey-Salinas and also along the coast to Santa Cruz

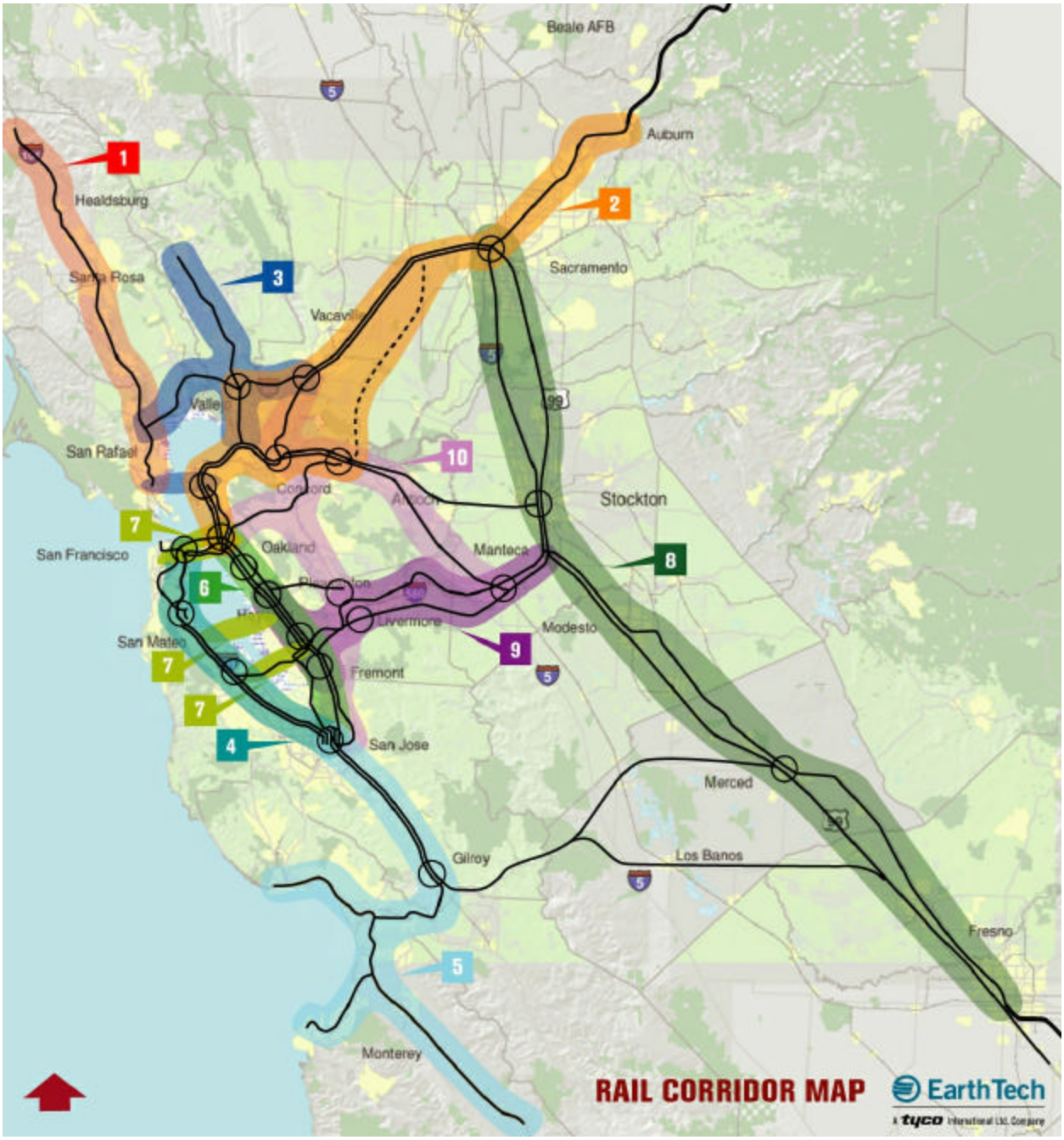
6. East Bay – Extends along the Capitol Corridor and Interstate 880 from Oakland to San Jose

7. Transbay – Infill corridor connecting the Peninsula cities with East Bay cities across San Francisco Bay; for the purpose of the study options will be separately identified in the Oakland – San Francisco section and in the Dumbarton crossing location[1]

8. Central Valley – Extends along the UPRR and BNSF central valley lines and Interstate 5 and Highway 99 from Auburn-Sacramento to Merced-Fresno

[1] The provision of rail service in the Highway 92 corridor was studied and ruled out as a result of the MTC Bay Crossings Study 2000 and the San Mateo/Hayward bridge was subsequently widened.

Figure 1
Corridors Map



9. Tri-Valley – Infill corridor connecting the Central Valley corridor with the East Bay corridor; includes the UPRR and abandoned SPRR rights of way as well as Interstate 580 and Route 84; connecting Hayward-Union City-San Jose with Tracy-Merced

10. I-680 – Extends along former San Ramon Valley branch line and Interstate 680 from Fairfield to San Jose; also includes east-west connectors such as Route 4 and Highway 24 (but not I-580 which is in the Tri-Valley corridor); for the purpose of this planning effort includes service options which serve eastern Contra Costa County extending down the UPRR Tracy Subdivision "Mococo Line"

DEFINING SYSTEM ALTERNATIVES – STEP 4: BUILDING BLOCKS WITHOUT HSR

Study Alternatives for systemwide networks without High Speed Rail have been identified by adapting the themes of Alternatives 1, 2 and 3 as defined in Table 1 to each of the ten corridors. The "Base Case" or "No Project" includes the existing financially-constrained Regional Transportation Plan (RTP) and includes nine rail extensions as well as services improvements to ACE, Caltrain and the Capitol Corridor identified in MTC Resolution 3434. The nine extensions are:

1. BART/Oakland Airport Connector
2. BART/East Contra Costa Rail (eBART)
3. BART/Fremont-Warm Springs Extension
4. BART/Warm Springs-San Jose
5. MUNI/Third Street Corridor & Central Subway
6. Caltrain/Downtown San Francisco Extension & Transbay Transit Center
7. VTA/Downtown-East Valley
8. Sonoma-Marin Rail (SMART)
9. Dumbarton Bridge Rail Service

Other considerations in the development of Systemwide Alternatives include consideration for whether BART could be readily extended into the corridor (e.g., Central Valley) and whether alternative routes suitable for development of freight bypasses would be necessary and or desirable. For this reason, not all of the elements that provide the basis of each of the first three systemwide alternatives will be present in each and every corridor.

DEFINING STUDY ALTERNATIVES – STEP 5: HIGH SPEED RAIL OPTIONS

Figure 2 on the following page indicates all of the alignment and station options that are currently under consideration for the purposes of the Regional Rail Plan.

There are two options for access to the Bay Area from the South paralleling SR-152 through Pacheco Pass to Gilroy continuing on the San Jose via the Caltrain right-of-way, one via Los Banos and the other via Merced. These options had been identified prior to the inception of the Regional Rail study and will be further refined for evaluation in the Regional Rail process.

There are three identified options for High Speed Rail access to the Bay Area from the East. The I-580 and UPRR right-of-way alignments cross Altamont Pass and a third option would enter via Patterson Pass and traverse south of Livermore and Pleasanton. (There are various sub-options for alignments across the Altamont using segments of the SPRR and UPRR rights-of-way, I-580 and tunnel.) The I-580 alignment would either follow I-580 to the Oakland and

Niles Subdivisions of the UPRR near the Bayfair BART station (in which case the BART branch would be upgraded to a High Speed Rail link) or the HSR line would shift over to the UPRR right-of-way west of Livermore leaving BART intact. Both the UPRR and southern alignments would be in tunnel through the Niles Canyon area connecting to the UPRR rights-of-way near Niles Junction.

Figure 2 shows all possible station locations; however not all stations would be stops for statewide service. For example, statewide stops with access from the South would be at Gilroy and San Jose and would be at Modesto, Tracy, one Tri-Valley location and one location near Hayward, Union City or Fremont with access from the East.

Alternatives 1, 2, and 3 indicate three combinations to represent the range of options with high-speed rail entry via San Jose. With high-speed rail entry from the east, six combinations (shown as Alternatives 4-9) present an appropriate range of options.

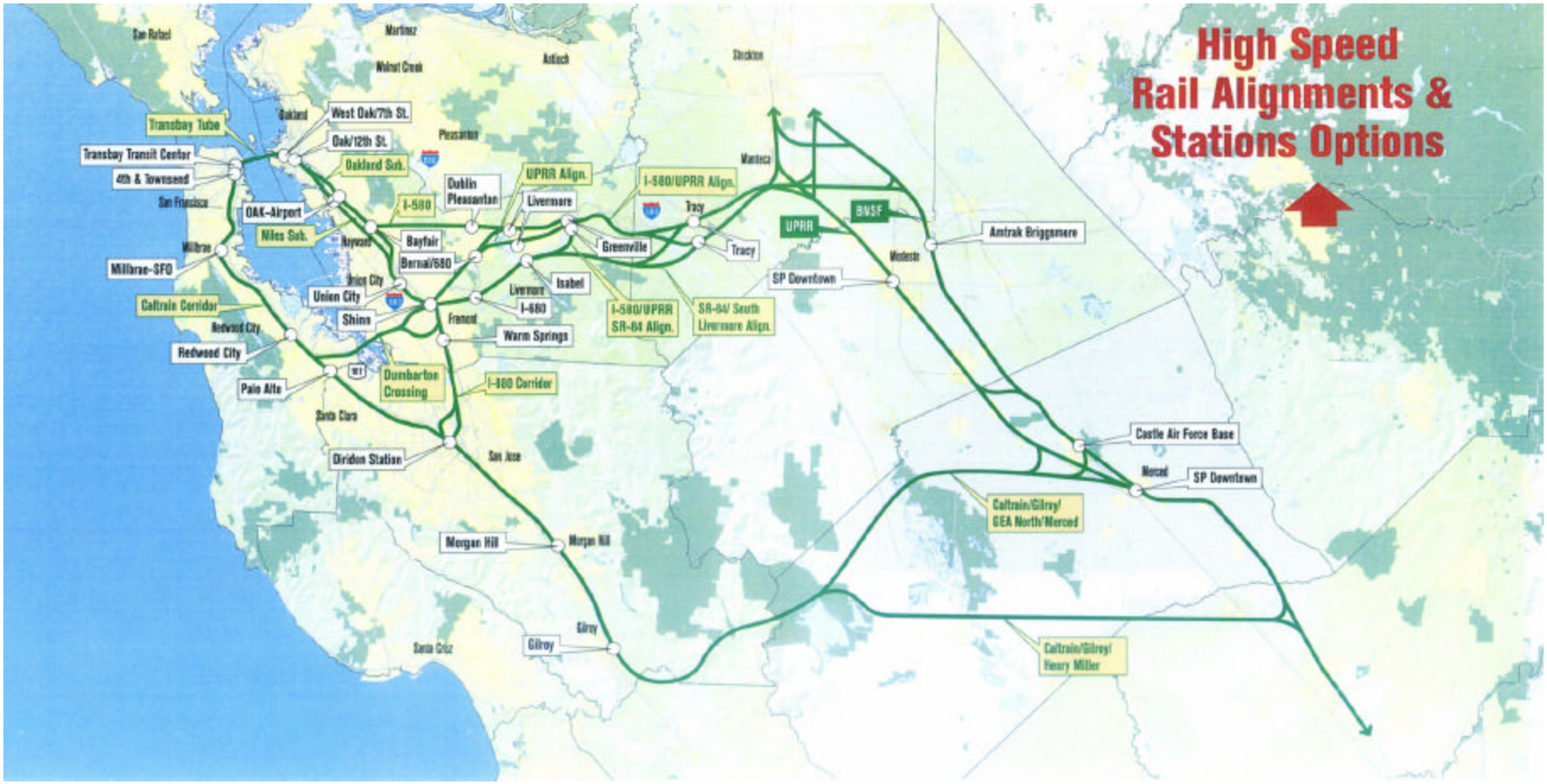
As noted previously, an HSR line could also support a regional "overlay" operation which would provide service to additional regional stops located along the high speed lines. Such local stops would typically be developed as four-track sections with a pair of outside platforms for regional trains and two express tracks (no platforms) in the center. The total extent of four-tracking required would depend upon the prevailing speed of the line for statewide service as well as the spacing and location of the overlay stops. The regional overlay services would be operated with compatible equipment but the overall travel times would be greater than statewide trains traveling along the route due to the additional stops as well as acceleration and deceleration.

As additional investment would be required to provide the infrastructure for such regional overlay services, these additional regional services need to be evaluated for cost-effectiveness. For this reason, overlay services have been indicated along various candidate links within the study area for each of the nine study alternatives with HSR.

In corridors where HSR links and overlay services are present these new lines would comprise the principal future rail investment in the corridor. The balance of the regional system has been completed by combining, on a corridor-by-corridor basis compatible "building blocks" from the three non-HSR alternatives (Alternatives 1, 2 and 3 as indicted in Table 1). The resulting Systemwide Study Alternatives therefore also indicate additional higher speed, separate regional passenger services operating with lightweight equipment, additional development of passenger corridors shared with freight, and additional freight by-pass lines matched up with the HSR route system.

Travel forecasting analysis will be accomplished to discriminate the performance of each of the twelve Systemwide Study Alternatives using a Year 2040/50 land use, in comparison to the financially-constrained Base Network. Analysis of the overall performance versus cost of each of the principal lines will be used to develop recommendations for lines and services which would be included in the long range regional rail plan. At this point there would be an opportunity to "mix and match" the best combination of services resulting in regional rail plans compatible with HSR options entering the Bay Area from either the South or East as well as with no HSR.

Figure 2
High Speed Rail Alignments & Station Options



SUMMARY

In summary, utilizing this methodology as a basis, the following twelve Systemwide Alternatives will be developed (all alternatives will be compared against the "No Project" option previously described):

Systemwide Alternatives 1 – 3
Without High Speed Rail

- One emphasizing BART Regional Expansion coupled with Railroad Services Shared with Freight
- One emphasizing BART Mass Transit coupled with development of Separate Lightweight Rail Network
- One emphasizing BART Core Capacity improvements, with corridor-specific Railroad treatments and including use of freight by-passes

Systemwide Alternatives 4 – 6
High Speed Rail Entering from South via San Jose

- Three different combinations of regional rail and HSR rail services from San Jose to San Francisco & Oakland

Systemwide Alternatives 7 – 9
High Speed Rail Entering from East via Tri Valley

- One via Altamont Pass generally following existing UPRR corridor (with tunneling and re-alignment suitable for high speed operation)
- One via Altamont Pass generally following I-580
- One via Patterson Pass immediately south of developed areas of Livermore and Pleasanton

Systemwide Alternatives 10 – 12
High Speed Rail Entering from East via Tri Valley

- Three additional combinations of linkages to provide access to Oakland, San Francisco and San Jose from the east

Included among the various High Speed Rail options will be variations including either a bridge or tunnel at the Dumbarton crossing and/or a new San Francisco – Oakland rail tunnel.